

Relating satellite-based contrail detection to NWA output

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Abstract

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Contrail-induced cloud cover has been shown to be a significant factor in regional climate change over the United States of America. As air traffic increases, the potential for globally significant impacts also rises. To better understand and predict these potential climatic effects, it is necessary to develop models that can accurately represent contrail properties based on ambient atmospheric variables including temperature, relative humidity and winds. Several high-resolution numerical weather analyses (NWA) including the 20-km Rapid Update Cycle (RUC-20) and the University of Oklahoma Center for Analysis and Prediction of Storms Advanced Regional Prediction System (ARPS) can provide the temperature, humidity and wind information necessary to diagnose contrail formation. One outstanding problem that must be addressed to achieve a realistic simulation of contrails is the large uncertainties in upper tropospheric relative humidity (UTH) in numerical weather analyses. Current numerical weather analyses tend to underestimate UTH due to large dry biases in the balloon soundings used to construct the analyses. To evaluate each of the models, we match one year of contrail properties derived from NOAA-16 observations to the NWA-derived humidity and vertical wind speed within a 4x6 deg grid box over the eastern US. The relationships between several contrail properties (including optical depth, areal coverage and longwave radiative forcing) and the NWA-derived moisture and vertical wind statistics will be analyzed to determine under which atmospheric conditions widespread contrail outbreaks are favored.